

Cancer

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N113

*What is the nurse's role
in cancer prevention ?*



Healthy People 2020

- Healthy People provides science-based, 10-year national objectives for promoting health and preventing disease.
- Currently, Healthy People 2020 is leading the way to achieve increased quality and years of healthy life and the elimination of health disparities.



Cancer

- Reduce the number of new cancer cases as well as the illness, disability, and death caused by cancer.
- Objectives New to Healthy People 2020
 - Increase the proportion of cancer survivors who report physical health-related quality of life similar to the general population.
 - Decrease incidence of invasive
 - Colorectal
 - Uterine cervical
 - Late-stage disease breast cancer

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Cancer

- Objectives, *cont.*
 - Increase the proportion of men who have discussed with their health care provider whether or not to have a prostate-specific antigen (PSA) test to screen for prostate cancer.

(www.healthypeople.gov)

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Prevalence and Incidence of Cancer



- Cancer is the 2nd most common cause of death after heart disease
- **Both incidence & death rates from all cancers gradually declining**
 - California, only state with decreasing lung cancer in women

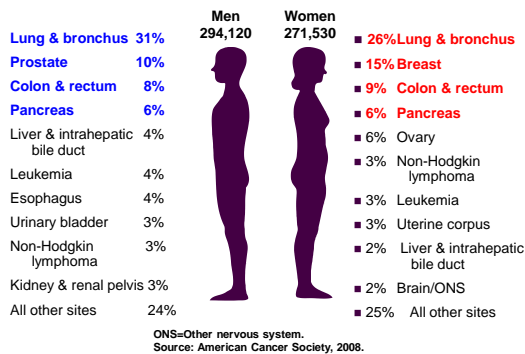
(www.cdc.gov/nchs/fastats/deaths.htm)

Types of Cancer within Different Ethnic Groups

- The cancer incidence & mortality rate are highest in African Americans.
- Overall incidence rates for all racial & ethnic populations combined ↓ by 0.8% per year from 1999 through 2005 in both sexes combined.
- The top 3 cancer sites were the same among all racial & ethnic groups, with some variation in rank order.

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2008 Estimated US Cancer Deaths



Barriers on Cancer Prevention

- Socioeconomic factor, i.e. low-income population
 - Lack of health insurance
 - Inability to pay fee-for-service
 - Limited health care access
 - Poverty, not race accounts for 10 to 15% lower survival rate from cancer in many cultural groups
- Knowledge level of risk factors, screening procedures and guidelines

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Barriers on Cancer Prevention, *cont.*

- Psychosocial
 - anxiety, embarrassment, dependency, inferiority, pessimism
- Cultural beliefs & practices
 - Fear of cancer leading to fatalism
 - Asians’ belief: “If one gets cancer, it is God’s punishment; God’s plan; bad karma.”
 - Complimentary Alternative Medicine (CAM)

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Barriers on Cancer Prevention, *cont.*

- Level of acculturation
- Health care provider’s enthusiasm to communicate need for compliance

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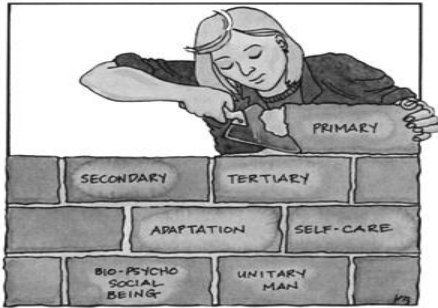
Cancer Prevention

- Reduction of cancer mortality by reducing the incidence of cancer
- Accomplished by
 - avoiding carcinogen or altering its metabolism
 - pursuing lifestyle or dietary practices that modify cancer-causing factors or genetic predispositions
 - medical intervention (chemoprevention) to treat precancerous lesions

(NCI, 2008)

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Role of the Nurse on Cancer Prevention



Role of the Nurse on Cancer Prevention

Primary Prevention

- Health promotion activities that are focused on protecting against the occurrence of cancer
- Teaching patients about healthy lifestyle behaviors
 - Strong association between tobacco use & cancer of many sites
 - Examples of modifiable cancer risk factors

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Role of the Nurse

Secondary Prevention

- Health behaviors that promote early diagnostic, treatment, & limited disability
 - Genetic testing for high-risk individuals
 - Enhanced surveillance
 - Screening, i.e. FOBT, Pap test

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Role of the Nurse

Tertiary Prevention

- Rehabilitation after a disease or condition already exists to minimize disability & help the person to live productively with limitations
- Aimed at minimizing disease progression & disability

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Role of the Nurse

Community outreach

- Seven warning signs of cancer:

CAUTION

Occupational surveillance programs

- Annual physical examinations

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Nursing Diagnoses

- Alteration in health maintenance
- Health seeking behaviors
- Anxiety
- Fear
- Ineffective individual coping
- Altered role performance
- Impaired social interaction

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Common Terminology in Cancer

- **Neoplasm**
 - A new and abnormal formation of tissue, as a tumor or growth
- **Carcinogenesis**
 - Transformation of normal cells into cancer cells, often as a result of chemical, viral, or radioactive damage to genes
- **Carcinogen**
 - Any substance or agent that produces cancer or increases the risk of developing cancer
- **Oncogenesis**
 - Tumor formation and development

(Taber's, 2009)
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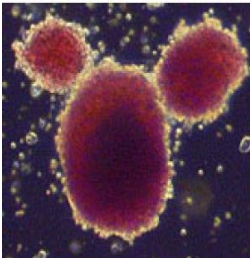
How do stem cells become differentiated tissue?

Stem cells

- Predetermined, undifferentiated cells in human tissues
- Stem cells of particular tissue will ultimately differentiate & become mature, functioning cells of that tissue & only that tissue.



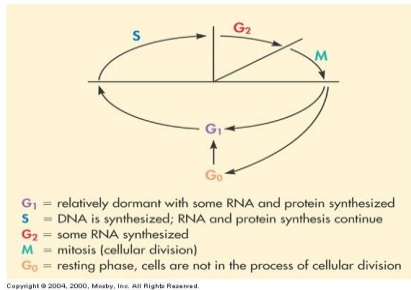
Stem cells, cont.



- Stem cell theory proposes that the loss of intracellular control of proliferation results from a mutation of stem cells
 - Stem cells are target or origin of cancer development

Cell Cycle Time

Five-stage process of reproduction that occurs in both normal & malignant cells

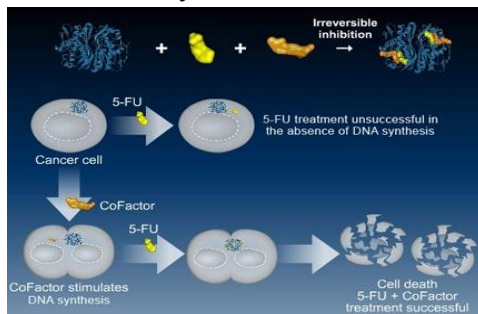


Significance of Cell Cycle Time

- Length of total cell cycle varies with the specific type of cell.
- The amount of time required for a cell to move from one mitosis to another mitosis varies.
- A shorter cell cycle time results in higher cell kill with exposure to cell cycle-specific agents (chemotherapy).

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Cell Cycle Time, cont.



Clinical implication: combination chemotherapy

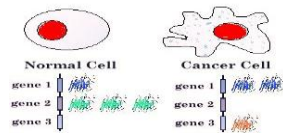
Normal Cells **Change** to Cancer Cells

Cellular differentiation

- Normally, there is an orderly process that progress from a state of immaturity to state of maturity
- As cells differentiate & mature, they are capable of performing only specific functions

Cancer cells de-differentiation

- Differentiated cell reverting to a previous undifferentiated state
- Genetic mutation

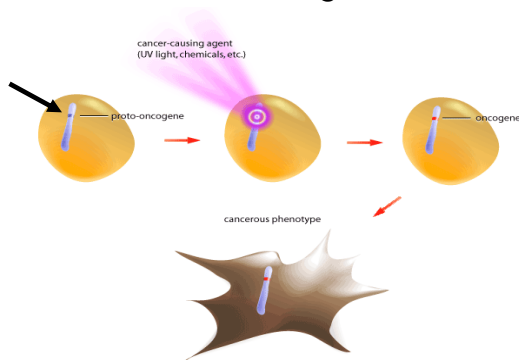


Proto-oncogenes

- Normal cellular genes that are important regulators of normal cellular processes
- Normally, genetic “lock” keeps cell in its mature state
- Carcinogen can “unlock,” resulting to revert the process of de-differentiation
- **Mutations** in proto-oncogenes cause the cell to become malignant

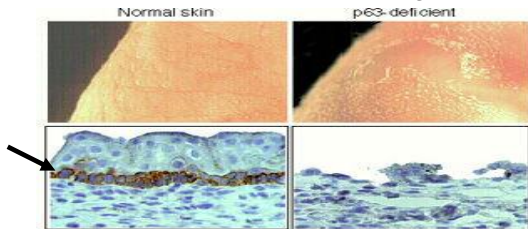
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Proto-oncogene



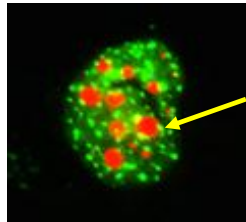
Tumor Suppressor Genes

- Suppress tumor cell growth
- Opposite of proto-oncogenes



Tumor Suppressor Gene

Illustration shows how *p53* tumor suppressor is regulated in DNA damage and attempt to resolve crosstalk and alterations of transforming growth factor- β (TGF- β) pathway in breast cancer.



Carcinogens

- **“Cancer promoters”**
- Any substance or agent that produces cancer or increases the risk of developing cancer
- Carcinogens may be radiation, chemical, or viral

Radiation Carcinogens

- Exposure to radiation can cause cellular DNA damage by a physical release of energy

1. Ionizing radiation - e.g. diagnostics & therapeutic sources

- Damage to the cell by this source is usually repaired & no mutation results
- Malignancy can occur when damage affects proto-oncogenes or tumor suppressor genes
- Children, fetuses, & elderly are at higher risk

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Radiation Carcinogens, cont.

2. Ultraviolet radiation (UVR)

- Complete carcinogen
- Sources: sunlight, tanning salons, industrial sources like welding arcs & germicidal lights

Risk of carcinogenesis

- Prolong exposure
- Hereditary diseases characterized by inefficient DNA repair
- Skin pigmentation- the greater amount of melanin, the greater is the protection against UVR



Chemical Carcinogens

- Chemical substances that alter DNA

Examples

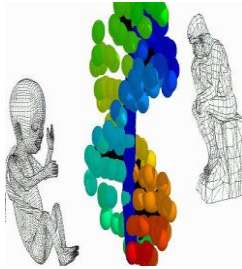
- Alkylating antineoplastic agents- cyclophosphamide, nitrogen mustard, nitrosoureas
- Aromatic hydrocarbons- soot, pitch, coal tar, **benzene**
- Tobacco products- cigarette smoke, chewing tobacco, snuff
- Inorganic compounds- asbestos, chromates, nickel



Nonsmoking women married to cigarette smokers had higher levels of NNK than women married to nonsmokers.

Viral Carcinogens

- Infect the DNA, resulting in proto-oncogene changes & cell mutation
- Effects modified by:
 - Age - the very young & elderly are more susceptible
 - Immunocompetence - many viruses are oncogenic only if the host is immunocompromised



Viral Carcinogens, cont.

- Examples of viruses:
 - Human papillomavirus – cervical CA
 - Hepatitis B – hepatocellular carcinoma
 - Epstein-Barr virus – Burkitt's lymphoma

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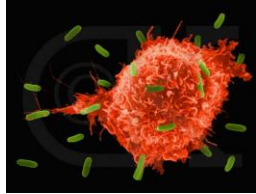
Immune System

- The system is composed of lymphatic tissues, organs, & physiological processes that identify an antigen as abnormal or foreign, & prevent it from harming the body.
- **Immune surveillance against cancer**
 - theory that proposes recognition & destruction of cancer cells by the immune system

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Immunologic Surveillance

- Surveillance occurs via recognition of tumor-associated antigens (TAAs)
- TAAs –mark some cancer cells as foreign or “non-self”



Immunologic Surveillance

- The immunologic functions are continuous.
- It is proposed that malignant transformation occurs continuously, & destroyed by the immune response.
- Surveillance prevents transformed cells from developing into clinically detectable tumors.

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Immunologic Surveillance, cont.

Cytotoxic T cells

- Play a dominant role in resisting tumor growth; capable of killing tumor cells
- Important in the production of cytokines

Natural killer cells

- Directly “lyse” tumor cells spontaneously without any prior sensitization

B lymphocytes

- Produce specific antibodies that bind to tumor cells & can kill these cells by complement fixation & lysis

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Immunological Surveillance, cont.

Monocytes

- ☐ Phagocytic white cells derived from stem cells; circulates in the blood stream for 24 hrs. then move into the tissues, where they mature.

Macrophages

- ☐ Mature monocytes
- ☐ One of the first lines of defense in the inflammatory process
- ☐ Phagocytes that engulf foreign antigens & cell debris
- ☐ Secrete cytokines & colony-stimulating factors

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Failure of Immune Response

Reasons

1. Constitutional factors

- ☐ Age- an immature or senescent immune system
- ☐ Tumor burden
 - Too little- insufficient to stimulate response
 - Too much- overwhelms the immune system

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Failure of Immune Response cont.

- ☐ Cancer cells may:
 - Suppress immune activity
 - Shield the cell from recognition
 - Resemble normal cells & thus escape detection = Immunological surveillance escape

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Failure of Immune Response cont.

2. Iatrogenic factors

- Immunosuppressive drug therapy, e.g. steroids, alkylating agents, cyclosporine
- Radiation-induced suppression of immune response

3. Genetic predisposition

- Certain cancers may be inherited; mechanism is unclear in many cases
- Examples: Wilm's tumor, familial polyposis coli, multiple endocrine neoplasia

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Genetic Link in "Cancer Families"

- Cancer has a multifactorial etiology with several genetic, environmental, & personal factors interacting to produce a malignancy.
- Genetic alterations are at the very core of cancer development, although most cancer is not the result of an inherited germline alteration.
 - It is believed that only 10% of cancers have a strong genetic link.

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Genetics, cont.

- Most cancer is associated with genetic alterations that occur in single cells sometime during the life of an individual.
- A malignant tumor arises after a series of genetic mutations have accumulated.

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Carcinogenesis

- Three-stage theory of causation (carcinogenesis) is the most widely used explanation of the process by which a normal cell is transformed into a cancer cell.
 - Initiation
 - Promotion
 - Progression
 - Metastasis

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Cancer Development

Initiation

- A carcinogen (cancer-causing agent) damages the DNA by changing a specific gene. This may result to:
 - Undergo repair (thus, no initiation occurs)
 - Become permanently changed (mutated) but do not cause cancer unless subsequently exposed to threshold levels of cancer promoters
 - Become transformed (mutated) & produce a cancer cell line if the initiator is a complete carcinogen

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Cancer Development, cont.

Promotion

- Process by which carcinogens are subsequently introduced, resulting in one of the following changes:
 - *Reversible damage* to the proliferation mechanism of the cell
 - Effects of cancer promoting factors may be inhibited by:
 - Cancer-reversing agents, e.g. antioxidants
 - Host's effective immune system
 - Time or dose limit on the exposure to the promoter

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Promotion, cont.

- *Irreversible damage* to the proliferation mechanism, resulting in cancer cell transformation
- Time frame
 - Time between exposure to initiators & promoters & development of cancer is quite variable
 - May depend upon dosage & length of exposure

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Cancer Development, cont.

Progression

- Characterized by increase growth rate of the tumor, as well as increase invasiveness & metastasis
- Invasion-
 - cells continue to divide; increase bulk, pressure, & secretion of enzymes resulting to local spread & invasion of surrounding structures

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Cancer Development, cont.

Progression, cont.

■ Metastasis

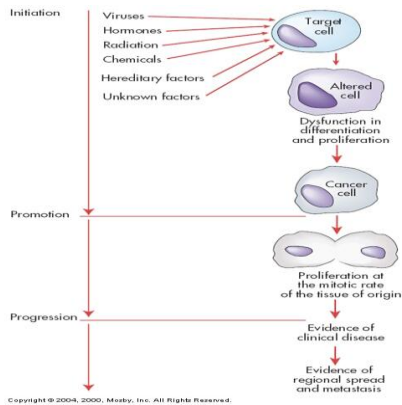
- Production of secondary tumors at distant sites
- Routes:
 - Seeding throughout the body cavity, i.e. peritoneal
 - Dissemination via the lymphatic system
 - Via blood capillaries & veins – most common form of metastasis

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Metastasis, cont.

- Most common sites:
 - Bones, lungs, liver, CNS
- Clinical implications
 - Metastasis is the major cause of death from cancer
 - Most tumors have begun to metastasize at the time of detection

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Common Screening Tests

- Examples of cancer-related studies
 - Cytology, e.g. Pap test
 - Sigmoidoscopy, colonoscopy
 - Guaiac for occult blood
 - Mammogram
 - CEA, AFP, CA-125, PSA, etc. as cancer markers
 - Genetic markers
 - Bone marrow examination
 - Biopsy

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Nursing Process

PATIENT CARE
Knowledge Heals



Diagnostic Phase

- The best & most effective treatment for cancer is prevention.
- Early detection of cancer & effective therapy can result in decreased morbidity & mortality.
- Diagnostic plan includes health history, identification of risk factors, physical examination, & specific diagnostic studies.

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Diagnostic, cont.

Biopsy

- Definitive means of diagnosing CA
- Histologic examination of a piece of tissue from the suspicious area by a pathologist
- To determine if the tissue is benign or malignant
- Types of biopsy: fine needle aspiration (FNA), incisional, excisional
- Biopsy result can take 72 hrs. to come out

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Histologic Analysis Classification

- Grading of tumors through the appearance of cells & degree of differentiation

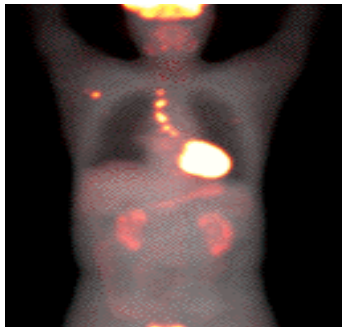
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|-----------|--|
| Grade I | Cells differ slightly from normal cells (mild dysplasia) & are well differentiated |
| Grade II | Cells are more abnormal (moderate dysplasia) & moderately differentiated |
| Grade III | Cells are very abnormal (severe dysplasia) & poorly differentiated |
| Grade IV | Cells are immature & primitive (anaplasia) & undifferentiated; cells of origin is difficult to determine |

Extent of Disease Classification

- Clinical staging – classifying the extent & spread of disease process

| | |
|-----------|---|
| Stage 0 | Cancer in situ |
| Stage I | Tumor limited to the tissue of origin; localized tumor growth |
| Stage II | Limited to local spread |
| Stage III | Extensive local & regional spread |
| Stage IV | Metastasis |

PET Scan (Positron Emission Tomography)



TNM Classification

- Standardization of the clinical staging of cancer by the International Union Against Cancer (UICC)
- Utilizes 3 parameters: tumor size (T), degree of regional spread to the lymph nodes (N), & metastasis (M)
- Refer to Lewis, p. 269

| Primary Tumor (T) | |
|-------------------|---|
| T ₀ | No evidence of primary tumor |
| T _{is} | Carcinoma in situ |
| T ₁₋₄ | Ascending degrees of increase in tumor size & involvement |
| T _x | Tumor cannot be measured or found |

TNM, cont.

| Regional Lymph Nodes (N) | |
|--------------------------|--|
| N ₀ | No evidence of disease in lymph nodes |
| N ₁₋₄ | Ascending degrees of nodal involvement |
| N _x | Regional lymph nodes unable to be assessed clinically |
| Distant Metastases (M) | |
| M ₀ | No evidence of distant metastases |
| M ₁₋₄ | Ascending degrees of metastatic involvement of the host, including distant nodes |
| M _x | Cannot be determined |

Nursing Care during Cancer Workup

- Education
 - Diagnostic procedures
 - "When will the results come out?"
 - Doctor's responsibility to explain the results and plan of care
- Psychosocial support
 - Health care team
 - Family & significant others

Independent & Collaborative Care for Cancer Patients



Cancer Decision Tree Treatment

Goal of Cancer Treatment

1. Cure

- ☐ Expectation after the treatment, patient will be free of cancer & will have a normal life span
- ☐ Permanent remission
- ☐ 5-year landmark to define cancer survivors
 - free of disease 5 years from diagnosis or from the completion of treatment
- ☒ Not true for all cancers

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Goal of Cancer Treatment, cont.

2. Control

- ☐ Limit the growth & spread of disease
- ☐ Cancers are not usually cured; considered to be chronic
- ☐ Maintenance therapy
- ☐ Patient is expected to have a period of symptom-free time

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Goal of Cancer Treatment, cont.

3. Palliation

- ☐ Relief or control of symptoms
- ☐ Maintenance of a satisfactory quality of life
- ☐ Life span is not expected to be extended
- ☐ Examples
 - Debulking of tumor
 - Colostomy
 - Laminectomy
 - Radiation therapy for bone metastasis

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Oncological Multidisciplinary Team

- | | |
|------------------------|----------------------------|
| ■ Medical oncologist | ■ Respiratory therapist |
| ■ Radiation oncologist | ■ Dietitian |
| ■ GYN oncologist | ■ PT, OT, Speech therapist |
| ■ Pathologist | ■ Case manager |
| ■ RNs, oncology nurses | ■ Social worker |
| ■ Palliative care | |

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Cancer Treatment Modality

Surgery

- Oldest form of cancer treatment
- Current trend
 - ☐ Less radical surgery
 - ☐ Adjuvant or “additional” therapy after surgery
 - ☐ Decision on adjuvant tx is based on tumor type, stage, comorbidities, & preferences

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Nursing Intervention: Surgery as Treatment Modality

- Post operative care specific to the surgery
 - Hemodynamics
 - Parameters monitoring
- Psychological support
 - Therapeutic communication
- Collaboration with other health care professionals

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Cancer Treatment Modality, cont.

Radiation Therapy (XRT)

- Approximately 50% of clients treated for cancer are treated with XRT during the course of disease
- Goals of XRT include delivering a precise dose of ionizing radiation to defined volume of tissue & minimizing the dose on the normal tissue in the treated volume
- Aims of XRT: Cure, Control, Palliation

Radiation, cont.

Methods of delivery of XRT

1. Local tx

Teletherapy

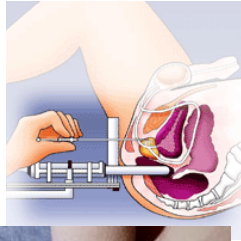
- External beam RT, wherein the precise dose is delivered to the client from outside the body

Brachytherapy

- Beta particles & gamma rays from sealed radioactive sources

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Brachytherapy



Radiation, cont.

2. Systemic tx

- ☐ Radiopharmaceutical treatment via IV, *oral*, or into a body cavity



Nursing Intervention: Radiation as Treatment Modality

- Client education & intervention to incorporate client & family in care
- Interventions to minimize the S/E's of XRT
 - ☐ Perform nursing assessment & interventions related to the area that is being treated
 - Skin Care
 - Fatigue
 - Nutrition

Nursing Intervention: Radiation as Treatment Modality, cont.

- Interventions to maximize radiation protection & safety with the “sealed” & “unsealed” source of XRT
 - Utilize the principles of TIME, DISTANCE, & SHIELDING



Cancer Treatment Modality, cont.

Chemotherapy

- Treatment of choice for malignancies of the hematopoietic system & for solid tumors that have metastasized regionally or distally
- Application of chemotherapy is based on the concepts of cell life cycle, cell cycle time, growth fraction, & tumor burden
- Goals are cure, control, palliation

Chemotherapy, cont.

Side Effects & Patient Care

- ☐ Nausea & vomiting, diarrhea, anorexia,
- ☐ Stomatitis, mucositis
- ☐ Easy fatigability, generalized weakness
- ☐ Alopecia
- ☐ Sexuality
- ☐ Chemotx adverse reaction

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Side Effects & Patient Care

- Neutropenia
 - ☐ Nadir – lowest point of blood cell levels after cancer treatment; occurs 7 to 14 days post chemotx
 - ☐ Risk for infection
- Anemia
 - ☐ Generalized weakness, SOB on minimal exertion

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Nursing Interventions

- Monitor CBC as ordered
- Report critical changes in patient assessment parameters to physician
 - ☐ Signs & symptoms of infection, Temp > 100.5 °F
- Teach patient & family on infection precautions
 - ☐ personal hygiene, hand washing, “oncology diet”
- Teach SQ administration of “growth factors” for home use
- Blood transfusion for moderate to severe anemia (per doctor’s order)

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Side Effects & Patient Care

- Thrombocytopenia

- Risk for bleeding

Nursing Interventions

- Avoid invasive procedures

- venipunctures, IM, SQ, enemas, rectal temperatures, suppositories, bladder catheterization, NGT

- Prevent constipation

- Use soft toothbrush, electric razor

- Teach safety measures to prevent bleeding when performing ADLs

- Platelets transfusion as ordered ($\leq 20,000/\text{mm}^3$)

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Chemotherapy, cont.

Alteration in self concept R/T

- Alopecia

- Cachectic condition

- Patient's own grieving process

- Strengthen client's support system

- Family, friends, significant others

- Cancer support groups

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Occupational Precautions when Caring for Chemotherapy Patients

- Chemotherapy administration is done by chemotherapy certified nurse

- Personal protective equipment (PPE)

- Chemo gloves, gown, mask, & goggles when administering chemotherapy

- Disposal of used chemotherapy IV bags, tubings, & syringes

- Specific precautions on patient's body fluids

- "Spills"

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Biological Modifiers

- Agents or approaches that change the relationship between the tumor & the host by modifying the biologic response of the host to tumor cells with a resultant therapeutic effect
- Goals
 - Cure (primary tx, e.g. interferon alpha for CML)
 - Control, maintenance (after chemotx, e.g. interferon alpha for multiple myeloma or lymphoma)
 - Combination tx
 - Supportive tx (e.g. growth factors – Procrit, Neupogen, Neumega)

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Current Trends

Stem cell

- Any cell that can give rise to more specifically differentiated daughter cells
- Stem cells can be harvested from bone marrow (BM), peripheral blood, or umbilical cord
- It is used in hematological transplants

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Current Trends, cont.

Bone marrow transplantation (BMT)

- Transplantation of bone marrow from one individual (allografting) to a recipient who is genetically different, or
- Transplanting marrow back into the person from which the blood cells are originated (autografting)
- Autologous marrow is preferred to avoid graft-versus-host disease (GVHD)

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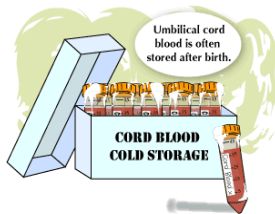
Stem cell banking at birth

- Stem cells from umbilical cord may be utilized if a match is found through the Cord Blood Registry, or if the baby is believed to be a match with a family member who requires an allogeneic transplant.
- Related & unrelated cord blood cells are harvested at birth from volunteer donors & are cryopreserved at a designated cord blood bank.

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Stem cell banking at birth, cont.

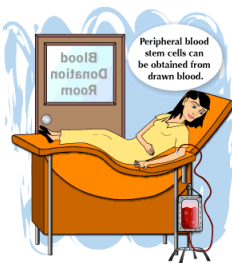
- The cells are transported to the recipient's transplant center, thawed, & infused on the day of transplant.



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Peripheral stem cell banking

- Peripheral blood stem cell from donor (allogeneic) or client (autologous) is harvested & processed.
- Processed marrow is placed in a blood administration bag for cryopreservation or immediate infusion.



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- Preparation of marrow recipient
- High dose chemotx & radiation
- 



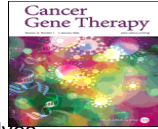
- transfusion
patient's stored
blood is thawed
and then
transfused through a
central venous catheter
- 
- 

Figure 46-10 Placement of single-lumen nonretained percutaneous central venous catheter.

Current Trends, cont.



Gene Therapy

- Experimental treatment that involves introducing genetic material (DNA or RNA) into a person's cells to fight disease
- Gene therapy is being studied in clinical trials (research studies with humans) for many different types of cancer and for other diseases
- First disease approved for treatment with gene therapy was adenosine deaminase (ADA) deficiency.

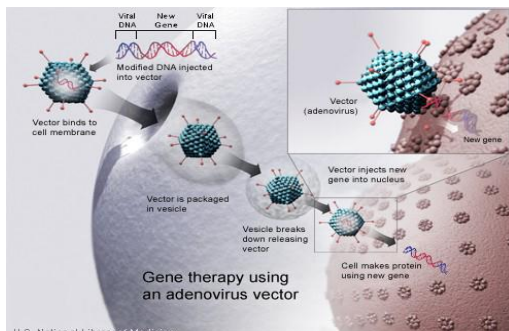
Gene Therapy, cont.

Approaches

- Target healthy cells to enhance their ability to fight cancer
- Target cancer cells to destroy them, prevent their growth, or make them more sensitive to chemotx & XRT
- Replace missing genes or altered genes with healthy genes
- Insert a gene to healthy cells to make them more resistant to S/Es of high dose chemotx

Gene Therapy

Genes are transferred into cells via carrier or vector, i.e. viruses



Levels of Care

- Critical care
- Acute care
- Medical/Surgical unit, Oncology unit
- Hospice
 - Skilled nursing facilities
 - Home care

Elderly Cancer Patient

- Over a third of cancers are diagnosed in people over 75 years old
- Research shows cancer in elderly people is less likely to be diagnosed & treated than in young people
 - More sensitive to toxic drugs used in chemo
 - Risks associated with surgery increase with age
 - "Nothing can be done"
 - Access to personal & medical services
 - "Age scrap limits"

- Cancer is a disease in which we can never have the luxury of looking back and saying, "*I wish I would have...*"
- Until the time, we discovered "*that magic drug, that magic bullet that would destroy cancer cells, but steer clear of other normal cells,*" we would have to lay greater stress on prevention of cancer through awareness about what causes it.



-Prof. Tim Hunt, Nobel prize winner
